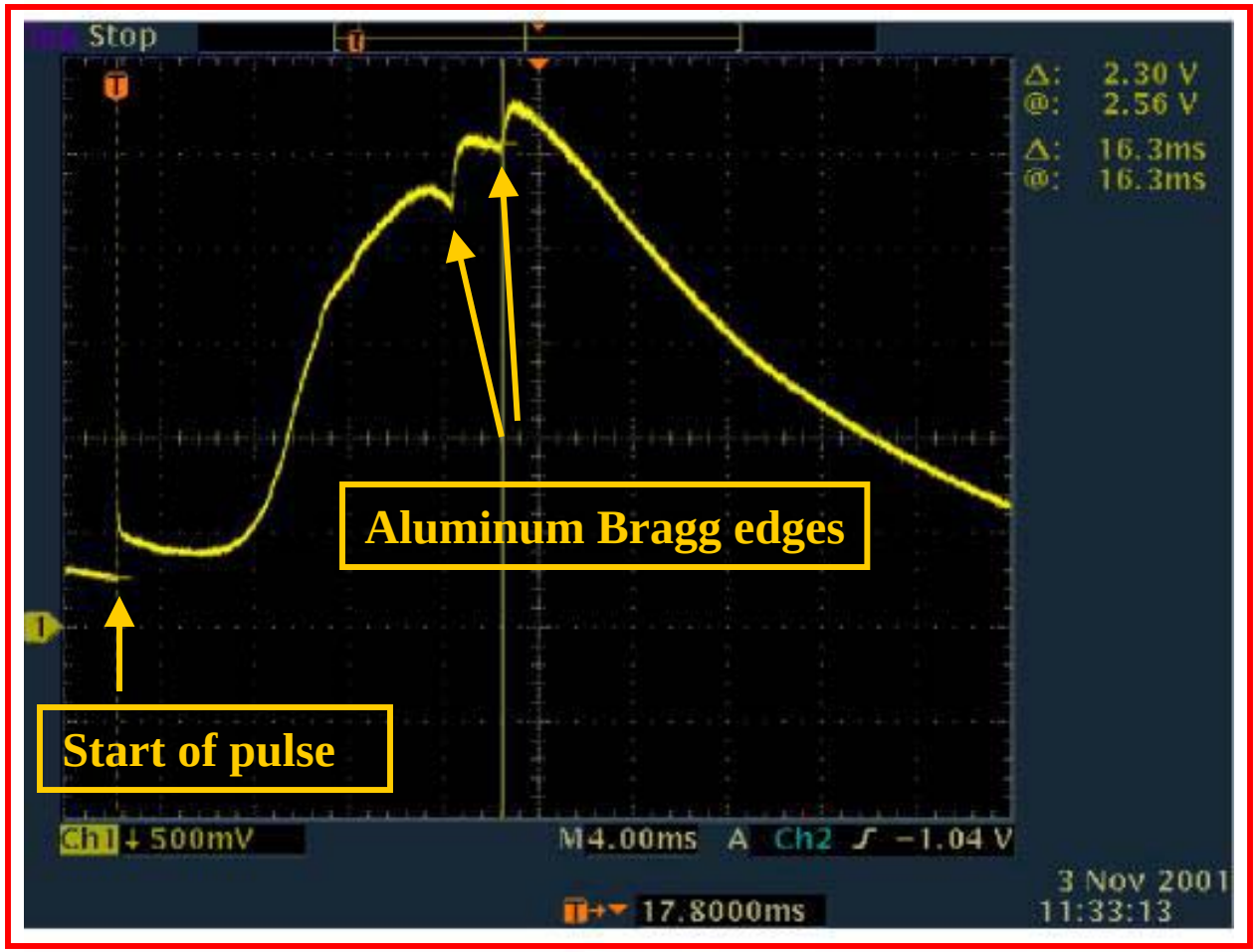
Beam Monitor Update - Fall 2001 Test Results



LND 27527

Sensitivity and intrinsic noise confirmed as predicted

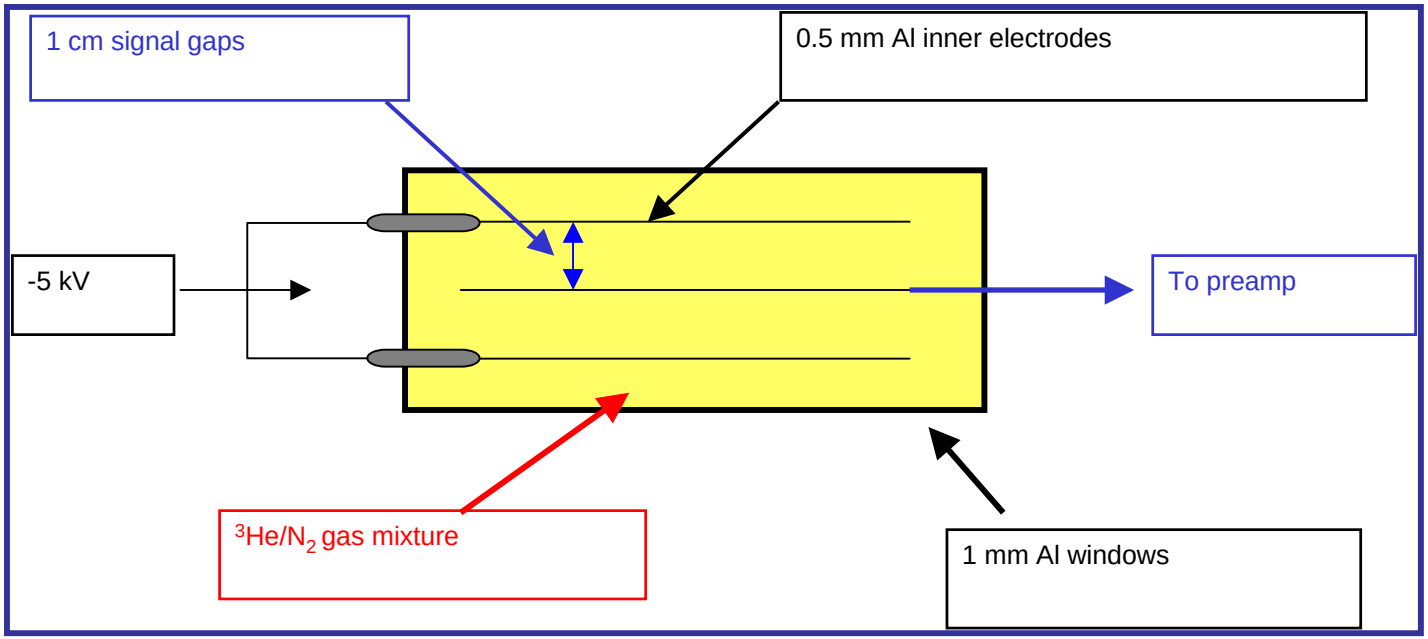
Neutron Beam Monitor Design:

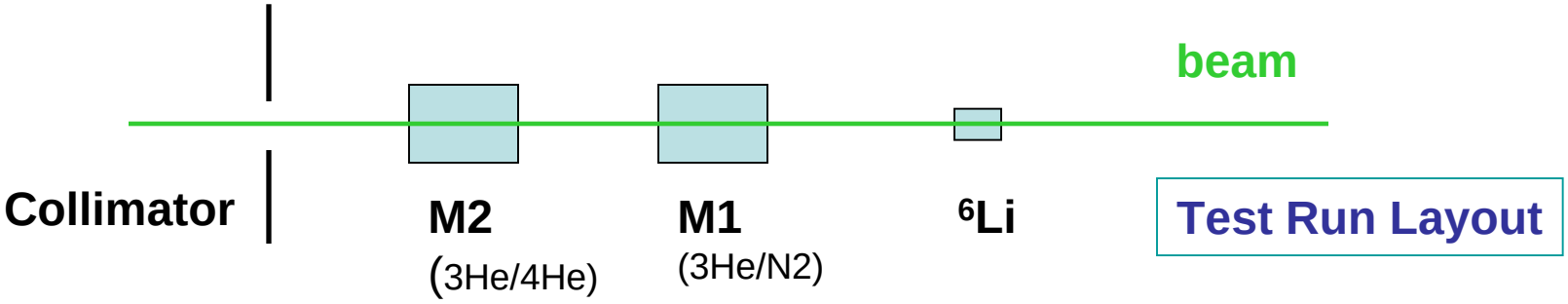
capture reaction: $^3He + n \rightarrow p + {}^3H + 0.77$ MeV (no γ-rays!)

$\sigma = \sigma_o(v_o/v) = 5327\ b \times 2.5 = 1.3 \times 10^{-20}\ cm^2$

Gain and Noise Simulation:
(not all fragments stop in the Sense region)

$$\frac{\delta I}{I} = \frac{1}{\sqrt{N}}\sqrt{1 + \left(\frac{\sigma_E}{E}\right)^2} = \frac{1.06}{\sqrt{N}}$$



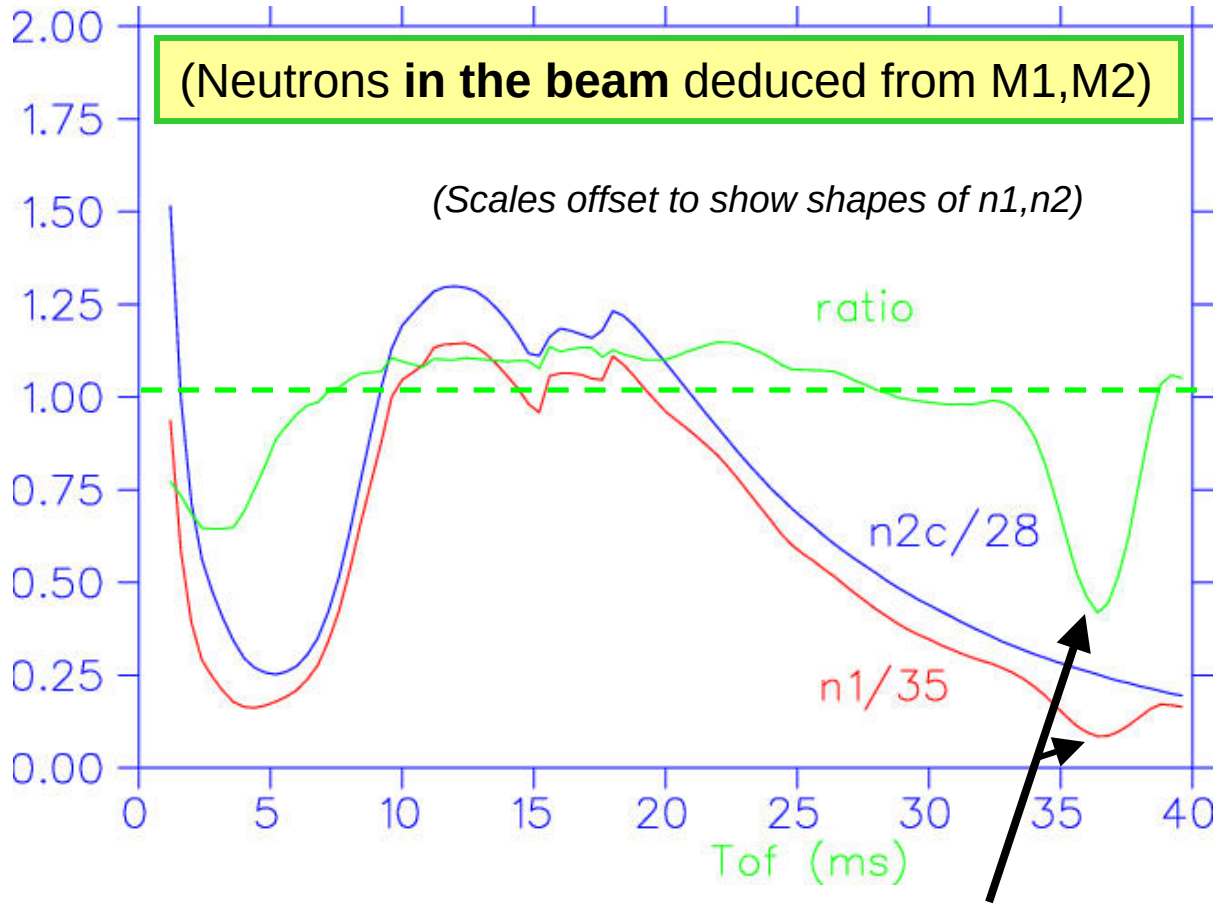


Noise measurement:
Ratio R of (M1/M2) integrated counts, plus knowledge of the beam flux, leads to the expectation $\sigma_R/R = 0.9\text{x}10^{-3}$ which compares well with the observed value of $1.0\text{x}10^{-3}$.

Sensitivity Check:
Expect $1.1\text{x}10^{4}$ ion pairs/neutron; observe $1.2\text{x}10^{4}$ compared to M2 and ^{6}Li, but with spurious ADC behaviour.

Lessons Learned:
Positioning and absolute time offset need more careful attention for exact comparisons. Digital scope gives a better tof calibration. We will have identical monitors to monitor the polarizer, and a thick one behind the target. Time domain spectra are better for tracking down glitches.

Fall 2001 Test Run – comparison of new and old beam monitors



New monitor had ADC problems → anomalous tof spectrum

Beam Monitor Status

- One prototype monitor with refill valve will be kept as a spare
- 3 more monitors ordered from LND in May, 2002. Will be delivered to LANL by Jan. 15, 2003. All identical except for gas filling. (2 are 1%, 1 is 50% at 4 meV)
- Need to specify non magnetic signal connectors – the ones on the prototype were slightly magnetic – just at the limit of detection at the 1 milliGauss level as a perturbation on a 10 Gauss field in the test lab.
- We should do a careful cross-comparison of two identical monitors as part of the beam commissioning, before using them to monitor the polarizer, etc.